Administrator's Column

(In this column NASA Activities features an article by NASA Administrator James M. Beggs. These articles focus on subjects chosen by him that address topics of broad interest to the agency's employees. The column this month features an address presented at the National Air and Space Museum in Washington, D.C.)

The Quest For Mars

Mark Twain once said: "Predictions are very difficult to make, especially when they deal with the future."

I won't quarrel with that. But even if the immediate future is uncertain I have no doubts about the more distant years. So I'll make a prediction. It is that some day human beings will rove the surface of Mars. They will crate up those wonderful Viking machines, return them to Earth and send them here to this museum. And future generations of children will come here and stand before not merely one, but three Viking landers, and imagine their journeys and the adventures of the people that replaced them.

Apollo opened the floodgates of the human imagination to the exciting possibilities of people exploring the Universe. Science fiction became fact because we demonstrated conclusively that humans could indeed leave Earth, land on another world and return safely to their mother planet.

Now that we have opened those gates, humankind will never be the same. We will take many more steps on many more worlds before we're through. And one of those worlds, most likely the first we will go to, will be Mars.

Indeed, we could be en route to Mars before the middle of the next century. By then, using as our springboard the Space Station and its infrastructure, which will include an inter-orbital transportation system, we may well have established a manned lunar base. Mars would be the next logical niche for human expansion in the Universe.

Why Mars? Mars will have priority in any manned solar system exploration program because it offers the least severe environment for humans. Due to its atmosphere, its accessible surface, its probable availability of water and its relatively moderate temperatures—they range from –120° C to +20° C—it is the most habitable of all the planets other than Earth.

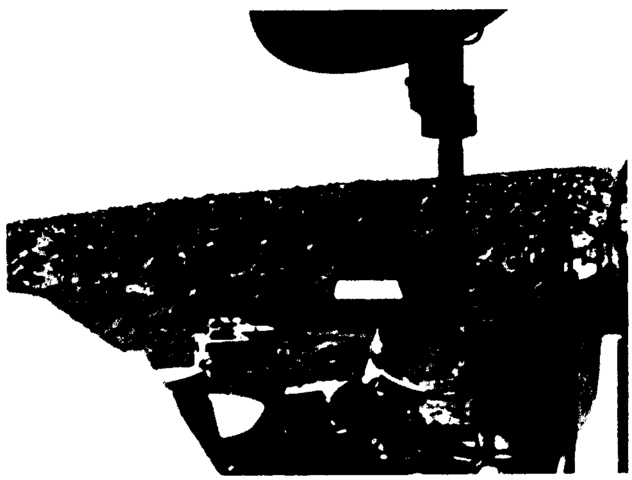
Moreover, Mars resources include materials that could be adapted to support human life, including air, fuels, fertilizers, building materials and an environment that could grow food.

There is a truism, but one that bears repeating, that the Universe doesn't care who explores it. It is we who care. And becaue we do, this epochal step in human exploration to a planet which could become a self-sufficient home for human beings, should be a cooperative international effort.

Indeed, given the enormous scope of such an effort, the resources required and its benefits to all mankind, it is tempting to say outright that it should be done unilaterally. Nevertheless, if the commitment and the resources were forthcoming, nothing would preclude a technologically sophisticated and dedicated nation from going it alone.

But whether a manned Mars mission should turn out to be a unilateral or a multilateral undertaking, one thing is clear. To make any sense, such a program must be viewed as a long-term commitment. It cannot focus merely on landing humans on the planet and returning them safely to Earth. A Mars landing must also include planning for subsequent sustaining operations. The first Mars explorers probably will not become permanent residents. Rather, they will set the stage for others to come. For others will come—to build, to live, to work, to learn and above all, to explore with their own hands, eyes, and tools this exciting and unknown world.

Mars has a special meaning as we look out into the Universe to plan our next steps in space in the post-Space Station era. It is attainable. It is livable. And



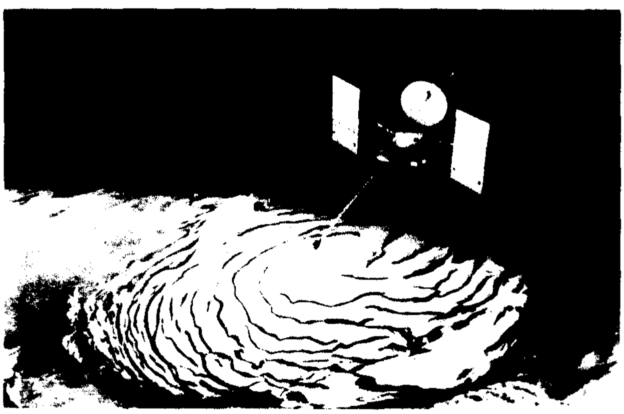
The surface of Mars photographed by the Viking 2 Lander.

its major mysteries remain unsolved. Space-age exploration of the planet has revealed it as a kind of "halfway world", in part, like Earth and in part, like the Moon and Mercury. What caused its climate changes? How did its surface features—the great rifts and huge volcanoes—form? Is the whole planet really lifeless? If so, why, given that next to Earth, Mars has the best environment to sustain life in the solar system?

Mars has a thin atmosphere, climate, weather and apparently, huge reservoirs of frozen water. Like the Moon and Mercury, the ancient, cratered surface of its southern hemisphere is little changed over billions of years. It probably bears evidence of the solar system's formation.

In Mars' northern hemisphere, huge volcanic mountains climb as high as 25 kilometers—three times higher than Mt. Everest and up to six times higher than any volcano on Earth. Elsewhere on this younger half of Mars, there is a 2800-mile-long canyon stretching three times deeper and seven times longer than the Grand Canyon of the Colorado. In that canyon is probably locked the whole geological history of Mars and perhaps, equally important, clues to the history of our own star, the Sun.

So Mars is geologically interesting. But we can study planetary geology with unmanned spacecraft. Indeed, we have done so on Mars with several unmanned spacecraft. Some have flown by the planet. Others have orbited it. And two have landed on it. We will continue to explore the planet with unmanned spacecraft.



An artist concept of the Mars Observer in polar orbit. Scheduled for launch in the 1990's, the spacecraft will observe seasonal changes during an entire Martian year.

In 1990, for example, we expect to launch the Mars Observer, which will do global mapping of Mars for a full Martian year, which is equal to two Earth years. We will focus on geoscience and climatology.

Later, unmanned spacecraft will surely focus on other science missions—such as the planet's upper atmosphere, its magnetic field, its seismology. And more ambitious unmanned missions would, most likely, return Mars samples to Earth. We have already demonstrated the ability to learn about other worlds from moon rocks, from meteorites and from cosmic dust. We can now apply proven techniques to determine the nature and history of Mars from its own rocks.

Indeed, by studying Martian rocks and soil in a laboratory right here on Earth, we may even settle the question of whether there is or ever been Martian life.

If we can learn so much about Mars with our robot spacecraft, why would we want to go there ourselves? Would we go for the same reason we climb a mountain—because it is there? I doubt it. We would need broader reasons than that. Consider Bernard Shaw's line from "Methuselah: "Some men see things as they are and say, why; I dream things that never were and say, why not."

Why not go to Mars to advance the human presence in space?

Why not go to Mars to build a permanent gateway to the Asteroid Belt and the outer planets?

Why not go to Mars to use human judgment, human abilities, and human intelligence to explore an exciting new world? Why not go there to recognize, to describe, to organize, to correlate and to solve problems as only humans can solve them, using all our experience and skill?

On Mars, we could unleash all the richness and subtlety—all the variety and versatility of the human mind and spirit—to plumb the mysteries of who we are, how we came to be and what our destiny might be. So why not go to Mars to better understand ourselves and our Earth, our ice ages, the effects of our atmospheric changes on our weather and climate? And, in T.S. Eliot's words: "The end of all our exploring will be to arrive where we started and know the place for the first time."

Why not go to Mars to stimulate progress in our own space capabilities, to develop new cutting edge technologies—propulsion, life support, habitation, non-terrestrial resource use? These will not only get us to Mars, but also leave their benefits on Earth.

And, finally, why not go to Mars to build on the framework for international cooperation the Space Station will have begun and, perhaps, a manned lunar base will have continued?

An immensely challenging program such as a manned Mars mission could be a strong force for peace in the world. It could redirect creative human brains from the prospects of dealing with armed conflict to the prospects of planning and carrying out a peaceful, stimulating and ultimately more valuable program of unprecedented scope and magnitude. Ironically, Mars, the primitive symbol of the God of War, could become a powerful instrument for peace.

"Humanity is just a work in progress," wrote Tennessee Williams. Indeed we are. And as we evolve and grow, I believe we will demonstrate that there are no limits to our future in the Universe.

Shakespeare understood that well. And, as usual, he put it best.

"Man is master of his liberty: . . .
There's nothing situate under heaven's eye
But hath his bound, in earth, in sea and sky,"

I believe that. There truly are no limits to what we can do if we have faith in the promise of the future.

Humans to Mars? Indeed, why not!

NASA Begins Simulated Airline Service Flights

The National Aeronautics and Space Administration will begin a series of simulated airline flights to operationally test new techniques to help smooth the air flow over aircraft wings.

Previous research has shown that smooth or laminar air flow can reduce aerodynamic drag from 25 to 40 percent under laboratory conditions and could provide significant fuel savings. However, in actual flight, laminar flow can be disrupted and disturbed by insects, ice, and other obstructions adhering to the leading edges of an aircraft's wings.

NASA's Ames-Dryden Flight Research Facility has installed on its business-sized JetStar aircraft two experimental laminar flow control devices incorporating techniques to help prevent leading edge contamination.

The simulated airline service flights will be flown in widely separated areas of the United States to experience a wide variety of contaminant conditions.

The JetStar will be based at various NASA installations and at commercial airports and will fly in and out of different airports to obtain information on various takeoff and landing situations that might affect the test articles. NASA will conduct the simulated airline service flights just as an airline would under normal air traffic rules and regulations.

While based at the different installations throughout the country, researchers plan up to four flights each day during a 2-week period to gather as much information as possible on performance of the test articles.

The two leading edge test articles, one installed on each wing of the JetStar, incorporate insect and ice protection with laminar flow control. Tests conducted on the JetStar in 1976 showed that the leading edge could be kept free of insects if it was kept wet while encountering them.

The test article installed on the left wing uses suction through 27 0.003-inch spanwise slots on the upper and lower surface to maintain laminar flow. A propylene glycol methyl ether (PGME)/water mixture is discharged through several slots at the wing leading edge and flows back over the wing for insect impact protection. This article was manufactured for NASA by Lockheed-Georgia.

The test article on the right wing uses suction through approximately 1 million 0.0025-inch diameter holes in the titanium skin to maintain laminar flow on the upper surface of the article. For insect impact protection, a shield is extended much like a wing leading edge flap on commercial transports. The shield is retracted at 6,000 feet altitude. Spray nozzles behind the shield can be used to spray the PGME/water mixture on the test article for additional insect protection.

For ice prevention during winter conditions, glycol is forced through the right wing's porous metal section of the shield leading edge in addition to the PGME/water spray. This article was manufactured for NASA by McDonnell-Douglas.

Since the simulated airline service flights are planned to approximate commercial flights as closely as possible, NASA officials are meeting with commercial airline officials to define what test conditions they would like to see flown and will incorporate the results of these discussions into flight planning. Researchers also are contacting entomologists in areas of the country that the JetStar will fly to determine the insect activity in each area.

The JetStar is configured as a "flying control room" with test instrumentation aboard. There are three consoles with data displays for researchers, who also have the ability to adjust the suction on the test articles if conditions warrant.

The JetStar will carry the Knollenberg probe, mounted atop the aircraft, to precisely measure the number and size of ice and water particles encountered in flight. A charge patch, located on the pylon that holds the probe, measures the static electric charge caused by particles in the air rubbing across the patch surface and gives a qualitative measure of ice and water particles. Correlation of the probe and patch data could calibrate the charge measurement in a simple cockpit display. Pilots could use the display to detect ice particles.